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## (54) PLASMA TREATMENT EQUIPMENT

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(\*) Notice:

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## (56) References Cited

#### U.S. PATENT DOCUMENTS

5,472,561 A 5,942,039 A \* 8/1999 Kholodenko et al. .... 118/723 E 6,051,100 A \* 4/2000 Walko, II ............................ 156/345

\* cited by examiner

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### (57) ABSTRACT

The invention provides a plasma equipment which is advantageous in that the suscepter impedance is small, the dependence on the frequency is low, the power consumption efficiency is high, the film forming speed is faster as compared with conventional plasma equipment, and the film quality is high. Metal plates AC short between a chamber wall and a shield of an electrode of the same DC potential as the chamber.

#### 12 Claims, 20 Drawing Sheets

